

## BIBLIOGRAPHICAL NOTICES.

ARTICLE XV. *Über das Pfortaderblut. Eine Chemisch-Physiologische Untersuchung.* Von Dr. C. H. SCHULTZ, Professor der Heilkunde in Berlin. pp. 42. Rust's Magazin für die gesammte Heilkunde, Bde. 44. Berlin. *Chemical and Physiological Researches on the Blood of the Vena Portæ.* By Dr. C. H. SCHULTZ, Professor of Medicine in Berlin, &c.

It was long since affirmed by well-informed physiologists, that the blood of the vena portæ differs essentially in many of its properties from that of the arteries and the general venous system. This opinion, which was at first chiefly predicated upon the difference of aspect presented by this portion of the circulating fluid, was subsequently called in question by the chemists, who declared that they could not, by the most careful analyses, detect any dissimilarity of composition in the portal and general venous blood. These assertions, coming, as they did, from such a source, had the effect of abating the confidence of physiologists in the belief that had been generally prevalent from the earliest periods of the science, and, as the subject has never been sufficiently investigated, the question still remains in a state of uncertainty. Even the researches which have been instituted, have not been conducted in such a manner as to lead to satisfactory or conclusive results—most of those who have had the subject under consideration, having confined themselves, exclusively, either to the examination of the chemical or physiological properties of the portal blood—Dr. Schultz very properly remarks, that legitimate inferences can only be deduced by combining the two methods of investigation; and this is the course which he has pursued in conducting the researches, the general results of which we propose to lay before our readers.

As it would be impossible to obtain portal venous and arterial blood from the human subject, in sufficient quantity for investigations of this kind, Dr. Schultz had recourse to animals, in which his labours were greatly facilitated by Gurlt, professor at the Veterinary School. It should be remarked, however, that only the results of the chemical experiments are detailed in this paper, the physiological being reserved for a separate work.

*External properties of the Portal Venous Blood.*—Dr. Schultz coincides in the general representation of authors, that the portal blood is of a darker colour than that of the general venous system. He remarks, however, that it varies considerably, and is often observed passing by insensible shades into the colour of the latter fluid. He found it exhibiting the darkest colour in horses during the state of fasting; but, after full feeding, it exhibited nearly the shade of venous blood. Its colour is indeed much more liable to vary, than that of either the blood of the arteries or the veins. The deep dark reddish coloured portal blood of a horse, mixed with muriate of soda and nitrate of potash, underwent no appreciable change of colour, while venous blood, treated in the same way, was converted into a bright red. On the other hand, portal blood of a lighter colour, was slightly reddened by neutral salts, but in a much slighter degree than common venous blood. Nearly the same difference was observed on exposing the two fluids to the atmosphere, the portal blood being but slightly or not at all changed, while that taken from the veins was manifestly reddened.

Dark portal blood, when freely shook in a closed vessel, with oxygen gas, was changed very slightly: venous blood treated in the same way, was converted into a bright red colour. The addition of the nitrate of potash and muriate of soda, to dark portal blood, scarcely coagulated it, even on the addition of water. The coagulation did not take place until after the expiration of some hours, and was extremely feeble, while venous blood, treated by the same agents, was firmly coagulated in the space of from five to ten minutes. Sulphuric ether, and a concentrated decoction of tobacco, produced the same effect on the blood of the general venous system, that they did on that of the vena portæ. Half an ounce of alcohol, of the strength of 54°, added to two ounces of portal blood, coagulated the lymph in form of flakes, but the blood itself remained fluid, and the globules were not apparently changed. No difference of taste could be observed in the portal and venous blood, except that the former was somewhat more mawkish, but never bitter.

*Coagulability.*—It was generally remarked by most of the earlier observers, that the blood of the vena portæ was always found in a fluid state after death, whence they inferred that it could not coagulate. Tiedemann and Gmelin, however, found that the fresh blood of the splenic vein coagulated readily, and did not differ sensibly from common venous blood. According to the observations of Dr. Schultz, dark portal blood, taken from a horse immediately after death, generally remained perfectly fluid, while that which was of a lighter colour, often coagulated as promptly as the venous blood. The coagulum, however, differed notably from that of both arterial and venous blood; the coagulum was always very loose, and, after twelve or twenty-four hours, became perfectly fluid, or subsided in form of a proper sediment upon the bottom of the vessel, and never presented itself in form of a solid concretion, floating in the serum. The portal blood, which was incapable of coagulating, deposited a similar sediment, consisting of its eruor, leaving the supernatent serum clear and transparent. The eruor of the portal blood was precipitated with extraordinary facility, during the agitation of the fluid, and the same thing was repeated after shaking it up, when it had already subsided. This, Dr. Schultz ascribes to the great quantity of colouring matter which adheres to the circumference of the globules, and is with difficulty suspended. In some cases, this blood was found in the vessels in a state of coagulation, several hours after death, but the coagulum always assumed again the fluid condition. It is thus apparent, that the ancient opinion, which inferred the non-coagulability of the portal blood, can be easily reconciled with that advanced by Tiedemann and Gmelin, since, as remarked above, the dark coloured portal blood does not coagulate, and although that of a lighter colour does undergo that change, the coagulum again becomes fluid after the lapse of some time.

*Quantity of Portal Blood.*—To ascertain this point, Dr. Schultz destroyed a horse by bleeding him to death. On opening the portal vein, between four and five ounces of blood flowed out spontaneously. About the same quantity was afterwards squeezed out of the splenic and mesenteric veins, making, in all, from eight to ten ounces. From the portal system of another horse, which was killed by a blow on the head, he obtained ten ounces and eight drachms.

*Proportion of Fibrine or Coagulable Lymph contained in the plasma of the Portal Blood.\* (Pfortaderblutplasma.)*—The imperfect and feeble coagulation

\*In order to avoid confounding the plastic portion of the living blood with the solid products formed by coagulation, Dr. Schultz has proposed the introduction of the term *blood plasma* to represent the first. The following explanation will serve to express his meaning. "The living blood consists of two parts. The first we denote *plasma*, the second *eruor*. The eruor consists of globules which are suspended in the plasma. By the process of coagulation, the plasma is separated into two portions, serum and fibrin or plastic lymph; so that, generally, the eruor combined with the fibrin forms the blood globules. Should the contact of the air be excluded, the eruor subsides in the plasma before coagulation takes place, and the latter is separated in form of a colourless fluid, which subsequently coagulates, and has its plastic lymph (fibrin) separated from the serum." p. 10.

of the portal blood, indicates that its plasma contains a smaller quantity of fibrin than that of arterial and common venous blood. To ascertain the quantity of this material, Dr. Schultz performed four experiments on the portal blood of horses. The blood employed in the two first was obtained from animals, which had been kept fasting for some time before they were killed; the third animal had been allowed food, during the twenty-four hours preceding death; and, in the fourth experiment, the blood was whipped, in order to prevent coagulation. We shall omit the details of the experiments, and content ourselves with furnishing a tabular view of the results of each.

The portal blood was found to contain:—

		<i>Wet Fibrin.</i>	<i>Dry Fibrin.</i>
In the 1st experiment,	- - - - -	1.75	0.38
2nd      "	- - - - -	0.98	0.38
3d      "	- - - - -	1.20	0.20
Medium quantity,	- - - - -	1.31	0.32
In the 4th experiment, in which the blood was skipped,	- - - - -	0.78	0.05

The quantity of fibrin obtained by whipping was, therefore, less than that obtained by coagulation,

Medium quantity obtained by whipping and coagulation,

In order to determine the quantity of fibrin contained in a given volume of the plasma, Dr. Sjöstrand

In order to determine the quantity of fibrin contained in the arterial and common venous blood of the same animals, Dr. Schultz next performed three experiments, in the two first of which the blood was treated by coagulation—in the third by whipping.

The following are the results obtained in the first of these experiments:-

		<i>Wet Fibrin.</i>	<i>Dry Fibrin.</i>
(a)	The arterial blood afforded	- - -	6·10
(b)	venous ,,"	- - -	6·98
		<hr/>	<hr/>
Medium	- - - - -	6·54	1·06
As, therefore, the medium quantity of fibrin obtained from the portal blood by coagulation was	- -	1·31	0·32
It contains less fibrin than the arterial and venous, by - - - - -	- - - - -	5·23	0·74

The third experiment, in which the blood was treated by whipping, afforded the following results:—

		<i>Wet Fibrin.</i>	<i>Dry Fibrin.</i>
(a) Arterial blood,	- - - - -	2·13	0·53
(b) Venous,	- - - - -	3·04	0·81
(c) Arterial and venous blood,	- - - - -	2·87	0·75
		Medium, 2·68	0·69

Portal blood affords by whipping, contains less fibrin, according to this ex- periment,	0.78	0.27
	1.09	0.42

The greater firmness of the buffy crust which forms in the blood of pregnant women, and in that drawn in certain states of inflammation, than of the crassamentum of healthy blood, Dr. Schultz thinks should be attributed to an increase in its fibrinous constituents. In order to test the validity of this conjecture, he instituted several experiments, the results of which are communicated. The blood was received as it flowed from the vessel in a portion of calf's intestine, having a funnel attached to the upper end. The intestine, after being filled,

was suspended by one extremity, either free or surrounded by paper, until the globules subsided, and the supernatent plasma became clear and transparent. In order to separate the clear fluid above, from the eruct in the lower portion of the tube, a string was drawn firmly round the latter, on a level with the line of demarcation between the two portions of the fluid, so as to completely isolate them.

The experiments were somewhat varied; but the following tabular view shows the ratio of the products obtained:—

		Wet Fibrin.	Dry Fibrin.
1. Plasma of venous blood separated in a portion of intestine, in the manner explained,	- - -	5.94	1.27
2. The same in connexion with the eruor,	- - -	2.21	0.57
Preponderance in the pure plasma,	- - -	3.73	0.70
	Medium in both,	4.07	0.92
3. Plasma of the arterial blood, coagulated in the open air,	- - - - -	7.33	1.52
4. The same in connexion with eruor,	- - -	1.45	0.31
Preponderance in the plasma,	- - -	5.88	1.18
5. Plasma of arterial blood coagulated in a portion of intestine,	- - - - -	5.21	1.19

If the result of this experiment be compared with that obtained in No. 3, it will be seen that coagulation in the intestine afforded less fibrin by

6. Venous blood, mixed with salt, afforded fibrine,	2.04	0.48
Giving less than in 1 and 2,	2.03	0.44

From these experiments, Dr. Schultz infers that the plasma of the blood cannot be properly considered as a mere chemical solution of fibrin in serum, but that it is a vital condition, which, by the process of coagulation, furnishes, under different circumstances, and according to the influences to which it is exposed, variable quantities of serum and fibrin—a result, which he thinks could not be obtained, if the fibrin merely existed in a state of chemical solution in the serum.

*Solid Constituents of the Portal Blood in particular.*—Under this head, we have a detail of some experiments made upon portal, arterial, and venous blood, taken from horses, both during fasting and after free feeding. We shall merely give the results.

In the first three of these experiments, the portal blood was found to contain solid constituents in the following proportions:—

Medium in the blood taken during fasting, - - - - - 16:90

Arterial blood obtained from horses during fasting, furnished in the 5th experiment.

Solid constituents, - - - - - 15·54  
 Venous blood from the same horse, - - - 18·6

Medium, 17.01.

Consequently, portal blood was found to contain less of solid constituents in animals, during the state of fasting, than the arterial and venous blood of the same in the proportion of 0.16.

The portal blood in the 4th experiment of this series, taken from a horse which had been fed freely on oats, furnished of solid constituents,	- - - -	20.3
The venous blood of the same animal,	- - -	19.5
The arterial blood do.	- - -	22.91

Medium of the arterial and venous blood,	-	20.7
The quantity of solid parts in the portal blood in the horse, after free feeding, was less than the medium of the arterial and venous blood in the same,	- - -	0.3

*Relative Proportion of Albumen and Salts contained in the Serum.*—It is interesting to know, what is the proportion of albumen and erumor contained in the solid parts of the blood, and to ascertain whether the same notable difference in quantity exists in these constituents, as is the case with the fibrin in the arterial and venous blood. In the experiments which were instituted in reference to these questions, the serum was observed to be transparent, both in the blood taken from horses during fasting and after feeding. In horses which had been previously fed, in which the chyle was found milky, this appearance could not be discovered in the serum of the blood.

Five experiments on the three species of blood furnished the following results:—

The portal blood furnished in the 1st experiment of this series, (fasting,) - - - -	-	8.16
Do. do. 2nd do. (fed,) - - -	-	9.67
	Medium,	8.90
Arterial blood, in the 3d experiment, (horse fasting,) - - -	-	9.86
Do. 4th do. (horse fed,) - - -	-	11.11
	Preponderance over portal blood,	10.48
Venous blood afforded, in the 5th experiment, (animal fasting,) - - -	-	1.58
Do. 6th do. (do. fed,) - - -	-	7.96
	Medium,	11.45
Greater than from serum of portal blood, - - -	-	9.70
	0.80	

We have next a detail of several experiments, made with the view of ascertaining the relative quantity of erumor in the three species of blood. We shall not give the numerical results, but merely state Dr. Schultz's inference. It is, that the portal blood contains relatively more erumor and less albumen than that taken from the arteries and veins. The two last species of blood, on the contrary, constantly contain less erumor and more albumen than the portal, a difference which accords perfectly with the phenomena observed during coagulation, in which, as previously remarked, the globules of the portal blood, surrounded by a thick crust of colouring matter, subside to the bottom of the vessel much more promptly than those of common venous blood.

*Oily constituents.*—The oily constituents of the portal blood afford much interest, on account of their relations with the albuminous and other materials of the bile, abounding in carbon. The experiments of Dr. Schultz on this subject show, that the portal blood contains nearly double the quantity of fatty matter that exists in the arterial and venous blood. Dried serum was found to contain 0.27 per cent less oily matter in the arterial and common venous, than in the portal blood; and similar experiments on the erumor showed 1.21 per cent. less oily matter in the two former species of blood, than in that of the vena portæ.

Dry fibrin was found to furnish a difference not less striking—that of

Arterial blood furnished of oily matter,	- - - - -	2·34
Portal blood,	- - - - -	10·70
	Difference	8·36.

Similar experiments on the serum of chyle, furnished of fatty matter 15·43 per cent. But this fatty matter differed essentially from that obtained from either of the three species of blood. Two-thirds of it remained fluid, like vegetable oil, and was of a white colour. About one-third was of the consistence of tallow, of a crystalline appearance, and in colour similar to the fat obtained from arterial and venous blood.

Having thus given a hasty summary of Dr. Schultz's interesting experiments, it only remains for us to present the conclusions which he has deduced from the entire series.

*Conclusions.*—“The portal blood differs from that of the arterial and general venous system, in the following particulars:

“1. The portal blood is always darker than the venous, notwithstanding it is sometimes difficult, with the eye, to distinguish the difference. The very dark portal blood is not reddened either by neutral salts or exposure to the atmosphere, and but slightly by oxygen gas.

“2. The portal blood either does not coagulate, or when it does undergo this change, the coagulum is much feebler than that of venous blood, and again assumes the fluid state after twelve or twenty-four hours, when a dark coloured deposit takes place, as in portal blood, which has not coagulated, leaving a supernatent transparent serum.

“3. Portal blood contains 5·23 per cent. moist, or 0·74 dry fibrin less than arterial or venous blood. By whipping 1·9 per cent. less moist, or 0·42 dry fibrin is obtained from portal than from arterial or venous blood.

“4. Fluid portal blood contains about 0·18 to 0·3 per cent. less of solid constituents than arterial and venous blood.

“5. Serum of the portal blood contains, on an average, 1·58 per cent. less of solid constituents than that of the arterial, and 0·80 less than that of venous blood. The exciseated serum of the portal blood is of an ash gray colour—that of the venous, yellowish-green, and of the arterial, yellow.

“6. Portal blood contains more eruor and less albumen. In arterial and venous blood the proportions are reversed. The dry eruor of the portal blood is of a dirty grayish-brown colour; that of the venous is dark red; the arterial is bright red.

“7. The solid constituents of portal blood contain nearly twice the quantity of fatty matter that exists in the arterial and venous blood; the proportion in it being 1·66; in the arterial blood only 0·92, and in the venous 0·83.

“8. The dried serum of the portal blood contains nearly 0·27 per cent. more fatty matter than that of the arterial and venous blood.

“9. The nubuminous portion of the eruor of the portal blood contains, in the dry state, 1·11 per cent. more fat, than that of the arterial, and 1·21 more than the eruor of the venous blood.

“10. The greatest difference is observed in the fibrin. The dried fibrin of the portal blood contains 10·70 per cent. of fat; that of the arterial blood only 2·34, presenting a preponderance of fat in the former of 8·36 per cent.

“11. The fat of the portal blood is of a dark brown greasy appearance; that of the arterial and venous blood is of a whitish yellow colour, and crystalline texture. The fat of the chyle is white, two-thirds of it fluid, and one-third crystalline.”

The subjects involved in this paper are of great importance in a physiological, as well as in a pathological point of view. The functions performed by the liver are still involved in much obscurity, and to enable us to arrive at any satisfactory conclusion in regard to the object of the great quantity of venous blood which is circulated through its substance by the vena portæ, one step certainly must be, to ascertain the qualities of that blood, which, differing as it

does in many essential particulars from that pertaining to the general circulation, is undoubtedly designed for some important end.

E. G.

---

ART. XVI. *Symbola ad Curationem Phthisicos Emendandam. Commentatio qua Viro Perillustri CHRISTOPH. GUILIELMO HUFELAND doctoratus in Medicina imperatrali Semisecularia gratulatur Universitas Literarum Regiomontana interprete Ludovico GUILIELMO SACHS, Facultatis Medicæ H. T. Decano. 4to, pp. 24. Regiomontii, 1833.*

*Contributions designed to improve the Treatment of Phthisis, being a Gratulatory Comment, addressed to the celebrated CHRISTOPH. WILLIAM HUFELAND, on the occasion of his attaining the fiftieth year of his service in the Medical Profession. By LUDOVICO GUILIELMO SACHS, Dean of the Med. Faculty, &c.*

In order to enable some of our readers to understand a part of the title of this brochure, it may be proper to remark, that a custom prevails in Germany amongst the members of the medical profession, of celebrating as a jubilee, the termination of fifty years service in the practice of the healing art, on the part of distinguished individuals. Such occasions are commemorated by festivities, gratulatory addresses, and all the ordinary methods of conferring honours, consistent with the objects of the ceremony. The custom has in it, we think, much to commend, and deserves to stand higher in the estimation of the philanthropist than all the gaudy pageantry attendant upon the act of conferring the civie crown upon the victor, or the insignia of power upon some ambitious despot. Within a few years several jubilees of this kind have been celebrated—in honour of the veteran Blumenhaeh, of Sæmmering, and last, of Hufeland, the first and the last of whom still live to enjoy the laurels so justly awarded to them by their professional brethren in all parts of the world; and it was on the occasion of paying this customary tribute to the last distinguished individual, that Dr. Sachs gave publicity to the small memoir which forms the subject of the present notice.

It may be justly said, that with Bayle and Laennec commenced a new æra in the pathology of phthisis pulmonalis. Notwithstanding the valuable contributions of their predecessors, the nature of this formidable disease was but very imperfectly understood, until they, by repeated and laborious investigations, threw new light on the most obscure parts of its pathology, by furnishing a rational explanation of tubercles, and pointing out the changes which these morbid products undergo, as well as the consequences to which they give rise. Still, with all the important additions they have made upon this subject, and, with the invaluable contributions which have been subsequently elicited, in consequence of the new direction given by them to researches of this kind, the treatment of phthisis, though certainly conducted upon more rational principles than in former times, is not productive of that ratio of success which ought to be obtained in a disease, the pathology of which is so well understood. This want of success might, perhaps, be referred to several causes, the exact influence of each of which cannot, at present, be correctly appreciated. One of these causes might, doubtless, be traced to the nature of the organ affected, its importance in the animal economy, and the extent to which its structures become involved. Another, we are inclined to think, may be, that we are not properly acquainted with the nature of the changes which take place in the tuberculous masses, especially of those modifications which occur in the portion of the pulmonary tissue adjacent to the site occupied by these adventitious developments. The question has often been asked, how are tubercles softened or disorganized? But, notwithstanding the various attempts to afford a